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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/511,566	04/13/2005	Jurgen Leib	2133.063USU	4191
27623	7590	03/20/2006	EXAMINER	
OHLANDT, GREELEY, RUGGIERO & PERLE, LLP ONE LANDMARK SQUARE, 10TH FLOOR STAMFORD, CT 06901			ARENA, ANDREW OWENS	
			ART UNIT	PAPER NUMBER

2811

DATE MAILED: 03/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/511,566

Applicant(s)

LEIB ET AL.

Examiner

Andrew O. Arena

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 October 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 and 34-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 and 34-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>10/15/2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Process of vapor depositing glass layers for wafer-level hermetic encapsulation of electronic modules.

2. The specification is objected to because of the following informalities: The recitation "Claim 24" (pg 2 ln 8, ln 12) seems to be a mistake, since claim 23 is the independent structural claim defining an "electronic module" (pg 2 ln 8-9).

Appropriate correction is required.

Claim Objections

3. A series of singular dependent claims is permissible in which a dependent claim refers to a preceding claim which, in turn, refers to another preceding claim.

A claim which depends from a dependent claim should not be separated by any claim which does not also depend from said dependent claim. It should be kept in mind that a dependent claim may refer to any preceding independent claim. In general, applicant's sequence will not be changed. See MPEP § 608.01(n).

Dependent claims 18, 19 (thus also 20), and 21, are separated from, and precede, the claims to which they refer, which is improper. Claims 34-39 are also separated from the claims (1, 15, 17) to which they refer.

Art Unit: 2811

4. Claims 5, 14, 18, 24, 39, and 40 are objected to because of the following informalities:

Claim 14 recites "a thickness sufficient to provide a hermetic seal." The metes and bounds of said limitation are unclear, rendering the claim indefinite. It is unclear exactly what thickness is sufficient to provide said claimed property.

Claim 18 recites "while leaving clear"; the metes and bounds of said limitation are unclear, rendering the claim indefinite.

Claims 5 and 24 are unclear because they refer to "the glass layer", which has antecedent basis if and only if interpreted to mean the "glass layer...deposited on the first...side" of claims 1 and 23; which cannot also be "deposited on the second substrate side." This error could be removed by changing the recitation of claims 5 and 24 to "a glass layer".

Claim 39 recites "lithographing plastic layers...to define the structure". It is unclear how lithographing plastic layers results in defining the structure.

Claim 40 recites "removing the plastic layers...comprises...elimination of the glass layer." It is unclear how said removing plastic involves removing glass.

Appropriate corrections are required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

Art Unit: 2811

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 23, 25-27, 31, and 32 are rejected under 35 U.S.C. 102(b) as being anticipated by Wada (US 2002/0019069).
7. Regarding claim 23, Wada discloses (Fig 1) an electronic module (1) comprising:
 - a substrate (6) having a first substrate side (A) and a second substrate side (B) opposite to the first substrate side ([0073] In 6);
 - one or more semiconductor structures (13) being disposed on the first substrate side ([0073] In 4-5);
 - a glass layer (9; [0077]) being deposited on the first substrate side; and
 - a plurality of etched pits (4) and line contacts (8) being defined on the second substrate side ([0074]).
8. Regarding claim 25, Wada discloses (Fig 1) a plastic layer (11; resin; [0075] In 7) that reinforces (by adhering: [0075] In 6) the module on the glass layer.
9. Regarding claim 26, Wada discloses (Fig 1) the second substrate side is thinned (interpreted as made to the desired thinness).
10. Further regarding claim 26, the product-by-process limitation "after the glass layer is deposited on the first substrate side" has not been given patentable weight. The case law establishing this precedent follows:

"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Art Unit: 2811

11. Regarding claim 27, Wada discloses (Fig 9) a passivation layer (26; [0136] ln 5) on the second substrate side.

12. Regarding claim 31, Wada discloses (fig 1) line contacts (8) that are connected to the one or more semiconductor structures ([0074] ln 6-8) on the first substrate side.

13. Regarding claim 32, Wada discloses (Fig 1) a ball grid array (24) at the line contacts.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wada as applied to claim 23 above, and further in view of Camlibel at al. (US 4,374,391) – hereinafter Camlibel.

16. Regarding claim 24, Wada differs from the claimed invention only in not disclosing a “glass layer being deposited on the second substrate side.” Camlibel discloses (Fig 5) an analogous device (60) with a glass layer (68) deposited on the back side. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Wada by depositing a glass layer on the

Art Unit: 2811

second substrate side, as taught by Camlibel; at least to protect the surface (Camlibel: col 3 ln 46).

17. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wada as applied to claim 23 above, and further in view of Butt (US 4,889,960).

18. Regarding claim 28, Wada differs from the claimed invention in not disclosing the glass layer comprises “a mixed layer of inorganic and organic constituents.” Butt discloses (Fig 1) electronic modules encapsulated with organic-reinforced glass (col 2 ln 67 – col 3 ln 6). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Wada by including organic constituents in the inorganic constituents of the glass, as taught by Butt; at least for reinforcing the glass (col 5 ln 11-15).

19. Claims 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wada as applied to claim 23 above, and further in view of Camlibel and Xu et al. (US 6,111,270) – hereinafter Xu.

20. Regarding claim 29, Wada differs from the claimed invention in not disclosing “a plurality of glass layers.” Camlibel discloses using glass layers both as a dielectric mirror and to reduce reflection (col 3 ln 51-53). Xu discloses a dielectric stack of layers forming a partial mirror to reflect light (col 3 ln 35-44). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Wada by forming the glass layer from a plurality of glass layers, in view of the

Art Unit: 2811

combined teaching of Camlibel and Xu; at least to reduce surface reflection (Camlibel: col 3 ln 53).

21. Regarding claim 30, Wada as modified by Camlibel and Xu discloses individual layers of the plurality of glass layers have different compositions (Xu: col 3 ln 37-39).

22. Claims 1-7, 9-14, 16-21 and 36-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wada in view of Camlibel.

23. Regarding claim 1, Wada discloses (Figs 6-9) a process for forming a housing for electronic modules, comprising the steps of:

providing a substrate (5; [0083] ln 1-2) having one or more regions, the one or more regions having a structure of semiconductor structure (13; [0083] ln 4), the substrate having at least a first substrate side (B; [0084] ln 1-3) to be encapsulated and an underside (A);

coating the first substrate side with a glass layer (Fig 9: 9; [0113] ln 1-2);

thinning the substrate (interpreted as making to the desired thinness, which is inherent) on the underside;

producing etching pits (Fig 6E-7G: 4; [0093] ln 1-2) on the underside;

producing line contacts (Fig 8A: 8; [0098] ln 4-5) on the underside.

24. Further regarding claim 1, Wada differs from the claimed invention in not disclosing the steps of:

“providing a vapor deposition glass source;”

“arranging the first substrate side in such a manner with respect to the vapor-deposition glass source that the first substrate side can be vapor coated;”

“vapor coating the first substrate side with a glass layer”.

Camlibel discloses (Fig 5) encapsulating an analogous device (60) by e-beam deposition (col 4 ln 47), which inherently comprises providing a vapor deposition glass source, arranging the first substrate side in such a manner with respect to the vapor-deposition glass source that the first substrate side can be vapor coated, and vapor coating the first substrate side with a glass layer. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the process of Wada by using e-beam deposition, as taught by Camlibel, as opposed to an adhesive; at least to prevent contamination from the adhesive.

25. Regarding claim 2, Wada discloses (Fig 9) the one or more regions are arranged on the first substrate side ([0084] ln 1-3).

26. Regarding claim 3, Wada discloses (Fig 9) providing the substrate with a passivation layer (26; [0136] ln 5) on a second side (A) that is on the opposite side from the first substrate side (B).

27. Regarding claim 4, Wada discloses the substrate comprises a wafer (5; [0083] ln 2), the process further comprising packaging components which still form part of the wafer ([00124] ln 1-5).

28. Regarding claim 5, Wada discloses coating a second substrate side with a protective film (26; [0136] ln 5), but differs from the claimed invention in not disclosing “vapor-coating a second substrate side with the glass layer.” Camlibel discloses (Fig 5)

Art Unit: 2811

vapor coating (e-beam; col 4 ln 47) a second substrate side with the glass layer.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the process of Wada by using a glass layer, as taught by Camlibel, for the protective film (26); at least for the optical transmission properties (Camlibel: col 2 ln 48-50).

29. Regarding claim 6, Wada as modified by Camlibel discloses the vapor-deposition glass source generates at least a binary glass system (borosilicate: Camlibel col 2 ln 55, is a binary glass).

30. Regarding claim 7, Wada as modified by Camlibel discloses the first substrate side is vapor-coated until the glass layer has a thickness in the range from 0.01 to 1000 μm (Camlibel col 7 ln 68; 3000 Angstroms = 0.3 μm).

31. Regarding claim 9, Wada as modified by Camlibel discloses the glass layer has a thickness in the range between 0.1 and 50 μm (Camlibel col 7 ln 68).

32. Regarding claim 10, Wada as modified by Camlibel differs from the claimed invention only in not expressly disclosing "the glass layer has a thickness in the range between 50 and 200 μm ." However, parameters such as film thickness in the art of semiconductor manufacturing are subject to routine experimentation and optimization. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the glass layer have a thickness in the range between 50 and 200 μm ; at least to optimize the glass layer's optical properties.

33. Regarding claim 11, Wada as modified by Camlibel discloses generating a vapor from a glass target by means of an electron beam (inherent in e-beam deposition; Camlibel col 4 ln 47).

34. Regarding claim 12, Wada as modified by Camlibel does not limit the borosilicate glass to any particular type, therefore the combined disclosure encompasses all well-known borosilicate glass types, including those containing aluminum oxide and alkali metal oxide fractions.

35. Regarding claim 13, Wada as modified by Camlibel discloses the glass layer has a coefficient of thermal expansion that is virtually equal to that of the substrate (Camlibel: col 2 ln 57-62; Fig 1, col 5 ln 7-18).

36. Regarding claim 14, Wada as modified by Camlibel discloses the glass layer has a thickness sufficient to provide a hermetic seal (any thickness sufficient to encapsulate is regarded as being sufficient to provide a hermetic (air-tight) seal).

37. Regarding claim 16, Wada discloses (Fig 6F-6G) removing material from a second substrate side ([0091] ln 1-2), the second substrate side being on the opposite side from the first substrate side.

38. Regarding claim 17, Wada discloses (Fig 3) the substrate includes a wafer (5) having a plurality of the structures (3; [0083] ln 1-2) wherein the process further comprises dividing the wafer to form a plurality of electronic modules which each have first encapsulated sides ([0124] ln 1-5).

39. Regarding claim 38, Wada discloses (Fig 9) applying a ball grid array at the line contacts (24; col [0137] ln 2).

Art Unit: 2811

40. Regarding claim 18, Wada discloses (Fig 9) providing the underside with a plastic covering (26; [0135]) while leaving clear the ball grid array (24).

41. Regarding claim 39, Wada discloses (Figs 6) lithographing ([0085], [0089]) plastic layers (32, 42, 44) on the substrate to define the structure and removing the plastic layers from the underside (Fig 6F-6G: 44; [0091] ln 1-2).

42. Regarding claim 19, Wada as modified by Camlibel discloses vapor coating the underside with the glass layer (Fig 11: 26) after the plastic layers (Fig 7F: 66) have been removed from the underside so that the plurality of electronic modules are encapsulated on both sides.

43. Regarding claim 40, Wada as modified by Camlibel discloses (Fig 11A-11B) removing the plastic layers (26) from the underside comprises uncovering the line contacts (8,22) by local elimination of the glass layers (in going from Fig 11a to 11B).

44. Regarding claim 20, Wada as modified by Camlibel differs from the claimed invention only in not expressly disclosing "the glass layer on the underside has a thickness in the range from 1 to 50 μm ." However, parameters such as film thickness in the art of semiconductor manufacturing are subject to routine experimentation and optimization. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the glass layer have a thickness in the range from 1 to 50; at least to optimize the glass layer's optical properties.

45. Regarding claim 21, Wada discloses (Fig 8A) filling in (interpreted as providing some amount of some filler) the etching pits with conductive material (8; [0098] ln 4-5).

46. Regarding claim 36, Wada discloses the etching pits are produced on the underside opposite the structure (Fig 8A: pits 4 are on underside A).

47. Regarding claim 37, Wada discloses the line contacts are produced on the underside opposite the structure (Fig 8A: contacts 8a are on underside A).

48. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wada in view of Camlibel as applied to claim 1 above, and further in view of Butt.

49. Regarding claim 8, Wada as modified by Camlibel differs from the claimed invention only in not disclosing the step of "providing a reservoir having organic constituents and converting the organic constituents into the vapor state through the application of a vacuum so that during the vapor-coating mixed layers comprising inorganic and organic constituents can be formed on the first substrate side." Butt discloses (Fig 1) electronic modules encapsulated with organic-reinforced glass (col 2 ln 67 – col 3 ln 6). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the deposition process of Camlibel used to modify Wada by providing a reservoir having organic constituents and converting the organic constituents into the vapor state through the application of a vacuum so that during the vapor-coating mixed layers comprising inorganic and organic constituents can be formed on the first substrate side, as taught by Butt; at least for reinforcing the glass (col 5 ln 11-15).

Art Unit: 2811

50. Claims 15, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wada in view of Camlibel as applied to claim 1 above, and further in view of Xu et al. (US 6,111,270) – hereinafter Xu.

51. Regarding claim 15, Wada as modified by Camlibel differs from the claimed invention in not disclosing “a plurality of glass layers.” Camlibel discloses using glass layers both as a dielectric mirror and to reduce reflection (col 3 ln 51-53). Xu discloses a dielectric stack of layers forming a partial mirror to reflect light (col 3 ln 35-44).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Wada by forming the glass layer from a plurality of glass layers, in view of the combined teaching of Camlibel and Xu; at least to reduce surface reflection (Camlibel: col 3 ln 53).

52. Regarding claim 35, Wada as modified by Camlibel and Xu discloses the plurality of glass layers have various glass compositions (Xu: col 3 ln 37-39).

53. Regarding claim 34, Wada as modified by Camlibel differs from the claimed invention in not disclosing “a layer of plastic above the glass layer.” Camlibel discloses using glass layers both as a dielectric mirror and to reduce reflection (col 3 ln 51-53). Xu discloses a dielectric stack of layers forming a partial mirror to reflect light (col 3 ln 35-44). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Wada by forming a layer of plastic above the glass layer, in view of the combined teaching of Camlibel and Xu; at least to reduce surface reflection.

54. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wada in view of Camlibel as applied to claim 1 above, and further in view of Miles (US 2005/0244949).

55. Regarding claim 22, Wada as modified by Camlibel differs from the claimed invention in not disclosing "plasma ion assisted deposition." Miles discloses ion assisted e-beam deposition. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the deposition process of Camlibel used to modify Wada by using ion assisted e-beam deposition in place of conventional e-beam deposition ; at least to control stress (Miles [0189] In 11).

Conclusion

56. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Pliskin (US 4,492,717) is relevant to the rejection of claim 12 in that it demonstrates that well-known borosilicate glasses contain aluminum oxide and alkali metal oxide fractions (Table I, between col 3&4).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew O. Arena whose telephone number is (571) 272-5976. The examiner can normally be reached on M-F 8:30-5.

Art Unit: 2811

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AOA
03/09/2006



EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800